PATENT SPECIFICATION (11) 1 472 581

1 472 581

(21) Application No. 32370/74 (22) Filed 22 July 1974 (19)

(31) Convention Application No. 2 337 953

(32) Filed 26 July 1973 in

(33) Fed. Rep. of Germany (DT)

(44) Complete Specification published 4 May 1977

(51) INT. CL.² G02B 5/16

(52) Index at acceptance

G2J 34A4 34A6A 34A6B

(54) DISPLAY DEVICE

(71) We, LICENTIA PATENT-VERWALTUNGS-G.m.b.H., of 1 Theodor-Stern-Kai, 6 Frankfurt 70, Federal Republic of Germany, a German Body Corporate, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to display devices and is particularly concerned with a screen for the reproduction of coloured images or patterns which has a plurality of light-conducting fibre end faces, from which light conducted by the light-conducting fibres leaves. It is known to arrange that certain light-conducting fibres or light-conducting fibre bundles in each case transmit light of only one basic colour and intermediate colours are formed in the eye of the observer by additive mixture of several, particularly three, basic colours.

Such screens for the reproduction of coloured images are already known, which comprise a multiplicity of end faces of light-conducting fibres which lie close to each other. From German Offenlegungsschrift No. 2,132,067 is already known a fluorescent screen comprising light-conducting fibres, in the case of which screen the individual light-conducting fibres are arranged at a greater spacing with respect to each other on the observer side than on the other side whereby the screen surface is enlarged relative to the cross-section of the light-conducting fibre bundles.

The present invention aims to provide a new type of display device which provides improved colour reproduction.

According to the invention, there is provided a display device comprising a screen and a multiplicity of light-conducting fibres or light-conducting fibre bundles coupled with and arranged to illuminate the screen, wherein the end faces of the light-conducting fibres or fibre bundles are arranged on the screen in groups of at least three and wherein the spacing between the fibres or fibre bundles in each group is less than the spacing between adjacent groups.

For the reproduction of coloured images or patterns, the display device preferably includes at least one light source which is conducted to the screen by said light-conducting fibres or fibre bundles, the light-conducting fibres or fibre bundles of each group in each case, being arranged to transmit light of only one basic colour and intermediate colours being formed in the eye of the observer by additive mixture of several, particularly three, basic colours.

In order that the invention and its various other feautres may be more easily understood an embodiment thereof will now be described by way of example only with reference to the accompanying drawing.

The drawing shows a portion of a screen 1, constructed in accordance with the invention, in plan view. In the case of the exemplary embodiment illustrated in each case the end faces of three light-conducting fibres transmitting green, red and blue light are combined to form groups of three. Substantially all the colours which can be reproduced can be reproduced with each triplet group. An additive mixture of the radiations takes place in the human eye according to the intensity of the individual basic colours so that such a group of three is in each case seen from some distance *in toto* as luminous in one colour.

The individual groups of three are arranged at a certain spacing from each other wherein the spacings of the individual groups of three from each other are greater than the spacings of the individual light-conducting fibres G, R, B from each other within a group. The spacing of the individual groups from each other is so selected that in the case of conventional viewing, with a normal spacing of an observer from the screen the mosaic structure of the screen is not readily apparent and so is not found to be disturbing by the observer. Preferably the spacing of the groups from each other is so selected that an enlargement of the screen area, by approximately factor 1.5 to 10 is achieved. The enlargement factor of the screen is related to a screen

in which the individual groups would lie if tightly packed next to each other.

In the case of the exemplary embodiment shown the individual groups 2 are shown in each case as a triangle. The three front faces of the three light-conducting fibres transmitting three basic colours can, however, just as will be arranged e.g. in a row lying next to each other. Light-conductor fibre bundles with for example two to five light-conductor fibres can be employed instead of a single light-conducting fibre. The end faces of the light-conducting fibres or light-conducting fibre bundles facing the observer can also be constructed as optically scattering or even as optically collecting lenses. Appropriately a plastics material or other casting material in which the ends of the light-conducting fibres are embedded with a desired spacing from each other can be used to hold the individual light-conducting fibre groups. In this way for example a flat or arcuate screen surface can be achieved.

Light of the corresponding basic colours can be radiated into the ends of the appropriate light-conducting fibres remote from the observer, for which purpose the free front ends of the fibres or fibre bundles may be coupled with radiators so as to transmit the appropriate basic colour and these radiators radiate their light into the respective light-conducting fibres. In the case of one embodiment such radiators are flat parts of an electrically or electronically controllable luminous screen, for example the luminous screen of a shadow mask cathode ray tube. Such a perforated shadow mask tube has, as is well known, a luminous screen, which comprises a plurality of luminous material elements each capable of being illuminated in one of three basic colours. For example free ends of the light-conducting fibres, which ends are correspondingly connected together, directly reproduce the picture carried by such a luminous screen.

In the case of another exemplary embodiment it is proposed to provide a single separate radiator for each basic colour. Such separated radiators are appropriately cathode ray tubes, the luminous screen of which lights up in each case only in one basic colour. For example three cathode ray tubes are provided the luminous screens of which are illuminated in red, green or blue. In this case, e.g. all the light-conducting fibres transmitting red light are combined together and led to the cathode ray tube with red luminous screen. Similarly, the fibres for green and for blue light are led to the cathode ray tubes with green and blue luminous screen respectively.

A further exemplary embodiment of the invention provides for radiators which comprise an illumination source transmitting a white light, in front of which is connected a liquid crystal cell which in a controllable manner allows through according to the control, only red, green or blue light.

Electroluminescent screens which are controlled with respect to the area can serve as radiators.

WHAT WE CLAIM IS:—

1. A display device comprising a screen and a multiplicity of light-conducting fibres or light-conducting fibre bundles coupled with and arranged to illuminate the screen, wherein the end faces of the light conducting fibres or fibre bundles are arranged on the screen, in groups of at least three and wherein the spacing between the fibres or fibre bundles in each group is less than the spacing between adjacent groups.

2. A display device according to claim 1 for the reproduction of coloured images or patterns and including at least one light source which is conducted to the screen by said light-conducting fibres or fibre bundles, wherein the light-conducting fibres or fibre bundles of each group in each case are arranged to transmit light of only one basic colour and intermediate colours are formed in the eye of the observer by additive mixture of several, particularly three, basic colours.

3. A display device according to claim 2, wherein, in the case of the reproduction of coloured images, the spacing of the individual groups of light-conducting fibre end faces is selected in such a manner that, at a specified distance from the screen surface, it is as large as possible without the mosaic structure being found to be disturbing to an observer at said distance from the screen.

4. A display device according to claim 2 or claim 3, wherein the ends of the light-conducting fibres or fibre bundles remote from the image screen surface which serve for the transmission of a basic colour are connected with one or more radiators emitting the appropriate basic colour.

5. A display device according to claim 4, wherein the radiators are flat parts of an electrically or electronically controllable fluorescent screen.

6. A display device according to claim 4, wherein a separate radiator is provided for each basic colour.

7. A display device according to claim 5 or claim 6, wherein the radiators are luminous screens of cathode ray tubes.

8. A display device according to any preceding claim, wherein the end surfaces

of the light-conducting fibres or fibre bundles are constructed as scattering optical lenses.

9. A display device substantially as described herein with reference to the accompanying drawing.

For the Applicants:
J. F. WILLIAMS & CO.,
Chartered Patent Agents,
113 Kingsway,
London, WC2B 6QP.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1977
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY
from which copies may be obtained.

1472581 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*